

Serial No. 09/910,497
Supplemental Response dated March 17, 2006
Reply to Office Action of October 3, 2005

Docket No.: 290397.0007
(97541.00007)

Amendments to the Claims:

1. (currently amended) A diol based, reduced toxicity, non-aqueous heat transfer fluid, ~~having an operating range with a lower temperature limit that is below minus 10°C at atmospheric pressure and an upper temperature limit that is above 150°C at atmospheric pressure~~ which can be used as an engine coolant in environmental conditions ranging from ambient temperatures of -35° F to +130° F, for use in a heat exchange system without any addition of water, said heat transfer fluid comprising:

(a) ~~a first diol consisting of ethylene glycol; wherein the ethylene glycol comprises between greater than 60 percent to about 70 percent by weight of the total weight of diols in the heat transfer fluid;~~

(b) ~~at least one second diol, propylene glycol, wherein the second diol propylene glycol acts as an inhibitor for ethylene glycol poisoning when it is mixed with ethylene glycol and wherein the ethylene glycol comprises between greater than 60 percent to about 70 percent by weight of the total weight of the ethylene glycol and the propylene glycol in the heat transfer fluid; and~~

(c) ~~at least one corrosion inhibitor additive that is soluble in the first and second diols ethylene glycol and propylene glycol, wherein the heat transfer fluid contains no additives that require water to be present in the fluid to dissolve the additives or to otherwise enable the additives to function.~~

2. (original) The heat transfer fluid of claim 1, wherein the corrosion inhibitor additive is selected from the group consisting of a molybdate salt, a nitrate salt and an azole.

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3. (currently amended) The heat transfer fluid of claim 1, wherein the ~~diols~~ ethylene glycol and propylene glycol comprise from about 85 percent by weight to about 99.85 percent by weight of the heat transfer fluid.

4. (cancelled) ~~The heat transfer fluid of claim 1, wherein the second diol is propylene glycol.~~

5. (cancelled)

6. (original) The heat transfer fluid of claim 1, wherein the corrosion inhibitor is comprised of a molybdate salt in a concentration of between about 0.05 percent to about 5 percent by weight of the total weight of the heat transfer fluid.

7. (original) The heat transfer fluid of claim 1, wherein the corrosion inhibitor is comprised of a nitrate salt in a concentration of between about 0.05 percent to about 5 percent by weight of the total weight of the heat transfer fluid.

8. (original) The heat transfer fluid of claim 1, wherein the corrosion inhibitor is comprised of an azole in a concentration of between about 0.05 percent to about 5 percent by weight of the total weight of the heat transfer fluid.

9. (original) The heat transfer fluid of claim 6, wherein the molybdate salt is sodium molybdate.

10. (original) The heat transfer fluid of claim 7, wherein the nitrate salt is sodium nitrate.

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11. (original) The heat transfer fluid of claim 8, wherein the azole is tolyltriazole.
12. (original) The heat transfer fluid of claim 1, wherein the corrosion inhibitor is comprised of at least one of (i) sodium molybdate in a concentration between about 0.05 percent by weight to about 5 percent by weight of the total weight of the heat transfer fluid, (ii) sodium nitrate in a concentration between about 0.05 percent by weight to about 5 percent by weight of the total weight of the heat transfer fluid, and (iii) tolyltriazole in a concentration between about 0.05 percent by weight to about 5 percent by weight of the total weight of the heat transfer fluid.
13. (original) The heat transfer fluid of claim 1, wherein
- (a) ethylene glycol comprises about 70 percent by weight of the total weight of diols in the heat transfer fluid;
 - (b) propylene glycol comprises about 30 percent by weight of the total weight of diols in the heat transfer fluid;
 - (c) sodium molybdate comprises about 0.5 percent by weight of the total weight of the heat transfer fluid;
 - (d) sodium nitrate comprises about 0.5 percent by weight of the total weight of the heat transfer fluid; and
 - (e) tolyltriazole comprises about 0.5 percent by weight of the total weight of the heat transfer fluid.

14. (cancelled)

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15. (cancelled)

16. (cancelled)

17. (cancelled)

18. (cancelled)

19. (cancelled)

20. (cancelled)

21. (cancelled)

22. (cancelled)

23. (cancelled)

24. (cancelled)

25. (cancelled)

26. (cancelled)

27. (currently amended) A method to reduce the toxicity of an ethylene glycol based, non-aqueous heat transfer fluid comprising the steps of:

(a) providing an ethylene glycol based heat transfer fluid; and

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(b) ~~adding a sufficient amount of a diol that acts as an inhibitor for ethylene glycol poisoning when it is mixed with ethylene glycol to reduce the toxicity of propylene glycol to the heat transfer fluid, wherein the ethylene glycol concentration of the resulting heat transfer fluid is between greater than 60 percent to about 70 percent by weight of the total weight of the diols ethylene glycol and the propylene glycol in the heat transfer fluid.~~

28. (cancelled) ~~The method of claim 27, wherein the diol that acts as an inhibitor for ethylene glycol poisoning comprises at least about 30 percent by weight of the weight of the diols in the heat transfer fluid.~~

29. (cancelled) ~~The method of claim 28, wherein the diol that acts as an inhibitor for ethylene glycol poisoning is propylene glycol.~~

30. (withdrawn) A method for cooling an internal combustion engine having a liquid based cooling system including at least one cooling chamber, at least one heat exchanger and at least one pump for circulating a heat transfer fluid, using a reduced toxicity, non-aqueous ethylene glycol based heat transfer fluid, said method comprising the steps of:

(a) substantially filling the cooling system with a non-aqueous heat transfer fluid comprising (1) ethylene glycol and (2) a sufficient amount of a diol that acts as an inhibitor to ethylene glycol poisoning when it is mixed with ethylene glycol to reduce the oral toxicity of the heat transfer fluid; and

(b) pumping the heat transfer fluid through the cooling system such that the heat transfer fluid absorbs heat in the cooling chamber that is produced by the internal combustion engine and releases the absorbed heat to the atmosphere through the heat exchanger.

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31. (withdrawn) The method of claim 30, wherein the diol that acts as an inhibitor to ethylene glycol poisoning when it is mixed with ethylene glycol is propylene glycol.

32. (withdrawn) The method of claim 31, wherein the propylene glycol comprises at least 30 percent by weight of the ethylene glycol and propylene glycol in the heat transfer fluid.

33. (withdrawn) The method of claim 31, wherein the heat transfer fluid further comprises at least one corrosion inhibitor additive that is soluble in ethylene glycol and propylene glycol.

34. (withdrawn) The method of claim 33, wherein the corrosion inhibitor additive is selected from the group consisting of a molybdate salt, a nitrate salt and an azole.

35. (withdrawn) A method for cooling a heat generating device having a liquid based cooling system including at least one cooling chamber, at least one heat rejection apparatus and at least one pump for circulating a heat transfer fluid, using a reduced toxicity, non-aqueous ethylene glycol based heat transfer fluid, said method comprising the steps of:

(a) substantially filling the cooling system with a non-aqueous heat transfer fluid comprising (1) ethylene glycol and (2) a sufficient amount of a diol that acts as an inhibitor to ethylene glycol poisoning when it is mixed with ethylene glycol to reduce the oral toxicity of the heat transfer fluid; and

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(b) pumping the heat transfer fluid through the cooling system such that the heat transfer fluid absorbs heat in the cooling chamber that is produced by the heat generating device and releases the absorbed heat to the atmosphere through the heat rejection apparatus.

36. (withdrawn) The method of claim 35, wherein the diol that acts as an inhibitor to ethylene glycol poisoning when it is mixed with ethylene glycol is propylene glycol.

37. (withdrawn) The method of claim 36, wherein the propylene glycol comprises at least about 30 percent by weight of the ethylene glycol and propylene glycol in the heat transfer fluid.

38. (withdrawn) The method of claim 36, wherein the heat transfer fluid is further comprises at least one corrosion inhibitor additive that is soluble in ethylene glycol and propylene glycol.

39. (withdrawn) The method of claim 38, wherein the corrosion inhibitor additive is selected from the group consisting of a molybdate salt, a nitrate salt and an azole.

40. (previously presented) The method of claim ~~27~~ 29, further comprising the step of adding to the non-aqueous heat transfer fluid a corrosion inhibitor additive that is soluble in both ethylene glycol and propylene glycol, ~~the diol that acts as an inhibitor for ethylene glycol poisoning~~, wherein the heat transfer fluid contains no additives that require water to be present in the fluid to dissolve the additives or to otherwise enable the additives to function.

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41. (previously presented) The method of claim 40, wherein the corrosion inhibitor is selected from the group consisting of a molybdate salt, a nitrate salt, and an azole.

42. (currently amended) The method of claim 27-29, wherein the ~~diols~~ ethylene glycol and propylene glycol comprise from about 85 percent by weight to about 99.85 percent by weight of the heat transfer fluid.

43. (cancelled) ~~The method of claim 29, wherein ethylene glycol comprises between greater than 60 percent and about 70 percent by weight and propylene glycol comprises between less than 40 percent and about 30 percent by weight of the total weight of the ethylene glycol and the propylene glycol in the fluid.~~

44. (previously presented) The method of claim 40, wherein the corrosion inhibitor comprises a molybdate salt in a concentration of between about 0.05 percent to about 5 percent of the weight of the heat transfer fluid.

45. (previously presented) The method of claim 40, wherein the corrosion inhibitor comprises a nitrate salt in a concentration of between about 0.05 percent to about 5 percent of the weight of the heat transfer fluid.

46. (previously presented) The method of claim 40, wherein the corrosion inhibitor comprises an azole in a concentration of between about 0.05 percent to about 5 percent of the weight of the heat transfer fluid.

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47. (previously presented) The method of claim 44, wherein the molybdate salt is sodium molybdate.
48. (previously presented) The method of claim 45, wherein the nitrate salt is sodium nitrate.
49. (previously presented) The method of claim 46, wherein the azole is tolyltriazole.
50. (previously presented) The method of claim 40, wherein the corrosion inhibitor comprises at least one of (i) sodium molybdate in a concentration between about 0.05 percent by weight to about 5 percent by weight of the total weight of the heat transfer fluid, (ii) sodium nitrate in a concentration between about 0.05 percent by weight to about 5 percent by weight of the total weight of the heat transfer fluid, and (iii) tolyltriazole in a concentration between about 0.05 percent by weight to about 5 percent by weight of the total weight of the heat transfer fluid.